COMMITTEE ON SCIENCE
U.S. HOUSE OF REPRESENTATIVES

HEARING CHARTER

Status of NASA's Programs

November 3, 2005
10:00 a.m. to 12:00 p.m.
2318 Rayburn House Office Building

Purpose

On Thursday, November 3, 2005 at 10:00 a.m., the Committee on Science will hold a hearing to review the status of plans and programs of the National Aeronautics and Space Administration (NASA). NASA Administrator Michael Griffin will provide a comprehensive update on all facets of NASA's plans and programs.

When Administrator Griffin last testified before the Committee four months ago, on June 28th, he described several reviews he had recently initiated, including:

- the Exploration Systems Architecture Study (ESAS) to define NASA's plans for returning to the Moon;
- the Shuttle/Station Configuration Options Team (S/SCOT) to examine the range of options for completing the Space Station and retiring the Space Shuttle by 2010;
- a review of the goals and plans for Project Prometheus, NASA's nuclear power and propulsion program; and
- plans for managing the recent $1 billion cost overrun on the James Webb Space Telescope.

Since that hearing, NASA has made significant progress in completing these activities. NASA has completed and released the results of the ESAS study, it has released preliminary results of the S/SCOT study, it has decided to significantly scale back Prometheus to a technology research program, and it has decided to slip the schedule for launch of the Webb telescope by two years. As a result of these decisions, NASA has begun reprogramming fiscal year 2005 funds and modifying its request for fiscal year 2006 appropriations.

The hearing is also timely as the House and Senate are beginning to negotiate a conference version of the NASA authorization bill, and a conference report on NASA appropriations for fiscal year 2006 is expected to be completed shortly.

Overarching Questions

The Committee plans to explore the following overarching questions at the hearing:

1. How can NASA afford to maintain a balanced portfolio of science and aeronautics programs, while also completing the International Space Station and accelerating the human exploration programs, especially given the agency's projected funding shortfalls?

2. What is the status of NASA's plans to define the final configuration of and research agenda for the International Space Station? What is the status of NASA's plans for returning the Space Shuttle to flight and for retiring it at the end of the decade?

3. What is the guiding philosophy NASA intends to use in developing new priorities for its aeronautics research program?

4. How does NASA intend to ensure the agency has the appropriate size and skill mix in its workforce, as well as the facilities and infrastructure necessary to support the agency's goals?

Key Issues (all discussed in greater detail in later sections of this charter)

Budget Dilemma. NASA's current plan is to fly 19 Space Shuttle missions between now and the end of 2010 (18 to the International Space Station (ISS) and one to service the Hubble Space Telescope). NASA has acknowledged that it is highly unlikely that it can accomplish the planned missions within the Shuttle's currently defined five-year budget, which is expected to decline by $4.8 billion over the next five years. Some estimates show the Shuttle may need nearly $6 billion more than currently budgeted to accomplish these flights. NASA's options for handling the expected shortfall appear to be limited. If NASA does not receive a significant increase in its projected budgets over the next five years, it will either have to drop its plans to accelerate the development of a Crew Exploration Vehicle (CEV) or it will have to significantly cut science and/or aeronautics. NASA has already proposed significant cuts in some areas of its exploration budget and in Space Station research to accelerate development of the CEV.

Exploration Architecture Released and Accelerated. NASA has completed the Exploration Systems Architecture Study (ESAS). In the ESAS, NASA proposes to deliver the CEV in 2012, two years earlier than the date originally proposed by the President. If it succeeds, Americans would return to the Moon by 2018. NASA will develop two new launch vehicles to be derived from Shuttle elements, one to launch the CEV and one to launch heavier loads. To accelerate the development of the CEV and its launch vehicle, NASA has begun reprogramming funds from within the agency's Exploration account. NASA has also increased its fiscal year 2006 request for the CEV and its launch vehicle by $785 million to $1.9 billion, a 70 percent increase. NASA estimates it will cost approximately $104 billion to send humans back to the Moon by 2019.

Space Shuttle Challenges Remain. The past three months have been a period of intense activity for the Space Shuttle program. The Stafford-Covey Return-to-Flight Task Group completed its work and issued its final report. The Space Shuttle completed its first "return-to-flight" mission but was subsequently grounded due to concerns from new foam debris. And, key Shuttle facilities were damaged in recent hurricanes, which along with investigations of the foam problem will delay the next Shuttle flight until at least May 2006.

The Stafford-Covey Task Group, which former Administrator Sean O'Keefe chartered to assess NASA's implementation of the Columbia Accident Investigation Board's (CAIB) 15 "Return to Flight" recommendations, issued its final report in August. The Task Group found that NASA had not met the CAIB's recommendations for (1) eliminating critical debris shedding from the External Tank; (2) hardening of the Shuttle orbiter against debris damage; and (3) developing the ability to inspect and repair the Shuttle in the event that it sustained critical damage. A minority opinion in the report further argued that NASA has not yet learned the lessons of the past, that NASA's cultural, management, and organizational problems persist throughout the human spaceflight program, and that NASA's leadership and management shortfalls generally made the return-to-flight effort more costly and lengthier than it needed to be. Since the time covered by

the report, however, Administrator Griffin has installed new managers in top-level positions throughout the agency, including within the human spaceflight program.

On July 26, NASA launched the Space Shuttle Discovery on the first mission since the demise of the Columbia Shuttle in February 2003. However, a few minutes after launch several chunks of foam fell off the External Tank. While the foam did not cause any damage to the Shuttle, it raised serious concerns over whether the problems that led to the Columbia accident had indeed been fixed. NASA then grounded the Shuttle fleet and established teams to review the potential causes of foam loss. The results indicate that the area where the largest piece of foam was lost had been damaged during ground processing of the tank. NASA believes it has traced the cause of other sources of foam debris, as well. While a final decision on how to address the foam problems has not yet been reached, NASA says it believes that tighter controls on processing and inspection, and a few specific and small design changes can prevent a repeat of the foam problem.

More recently, Hurricane Katrina caused significant damage to key Space Shuttle facilities, particularly the facility outside of New Orleans that manufactures the Shuttle's External Tank. Damage sustained from Katrina will cost the agency an estimated $760 million. The Administration's latest Supplemental Appropriations request includes $325 million to cover part of the cost.

International Space Station (ISS) Configuration and Research Plan Cut. To determine what options the U.S. has in completing the ISS and meeting U.S. international commitments if it plans to retire the Shuttle in 2010, Administrator Griffin chartered the Shuttle/Station Configuration Options Team (S/SCOT). As a result, NASA now plans 18 more Shuttle flights to complete construction of the ISS in a way that will allow a six-person crew to work onboard. NASA will continue to use Russian vehicles, as necessary, to ferry crew and cargo to the ISS, and has promised to take steps to engage private companies for that task. NASA has announced that it will not launch one piece of equipment that had once been viewed as central to ISS research – the centrifuge (technically the Centrifuge Accommodation Module (CAM), which the National Academy of Sciences has said is important to understanding the impact of long duration space flight on the body. Also, NASA has cut Space Station- related research funding by nearly half, from the original budgeted level for fiscal year 2005 of about $1 billion to $533 million under the most recent proposal for fiscal year 2006.

Aeronautics Plans Revamped. Administrator Griffin has appointed Dr. Lisa Porter, a former official at the Defense Advanced Research Projects Agency (DARPA) as the new Associate Administrator for Aeronautics. Since her arrival, Dr. Porter has begun significantly revamping the aeronautics program. Her basic thrust has been to move away from technology demonstration projects to more fundamental research, and she has eliminated much of the research on security issues. The NASA authorization bill that the House passed in July directs the Administration to develop a National Aeronautics Policy to guide NASA's aeronautics research program.

Background

Results of the Exploration Systems Architecture Study (ESAS)

The Exploration Systems Architecture Study (ESAS) outlines NASA's approach to implementing the Vision for Space Exploration, which was announced by President Bush in January 2004. The Vision calls for NASA to return the Space Shuttle to flight, complete the International Space Station, return humans to the Moon, and prepare to send humans to Mars and beyond.

To send humans back to the Moon, NASA plans to develop a Crew Exploration Vehicle (CEV) and a CEV launch vehicle (CLV), the latter of which will be based on the solid rocket boosters used by the Space Shuttle. To carry cargo and other equipment necessary to go to the Moon, NASA plans to develop a second launch vehicle capable of carrying more mass than the Saturn V rocket used in the Apollo program. That heavy-lift launch vehicle will use both the solid rocket boosters and a modified version of the external fuel tank used by the Shuttle. In this way, NASA hopes to take advantage of skilled labor and technical know-how it has already mastered in developing its new capability to carry crew and cargo into Earth's orbit as the first stage of a lunar mission. NASA examined and rejected alternative launch approaches such as using modified versions of the rockets that were developed to launch military satellites.

To carry humans from Earth's orbit to the surface of the Moon, NASA plans to develop new equipment, including a lunar command module, a lunar lander, and a vehicle to return the crew from the surface of the Moon to the command module. The CEV will be designed to carry six crew, and the lunar equipment to carry four crew. As these numbers are double the size of Apollo crews, Griffin has described the project as "Apollo on steroids."

In the ESAS, NASA proposes to accelerated the CEV by two years to 2012 from 2014, the date originally announced by the President last year. Griffin wants to accelerate the development of the CEV to minimize any gap in the U.S. ability to launch humans to space after NASA retires the Shuttle (which NASA must do to afford the new Vision and to reduce the exposure of astronauts to the risk of another Shuttle accident) in 2010. NASA intends to begin procurement of the CEV and the CLV later this year and anticipates awarding contracts in May and June of 2006, respectively. The heavy launch vehicle will be developed somewhat later.

The ESAS provides for a CEV capable of serving the International Space Station (ISS) as well as allowing human missions to the Moon for week-long stays as early as 2018. NASA hopes to embark on longer-duration stays on the Moon by 2022.

The ESAS changes the Prometheus Nuclear Systems and Technology program from a large development program to a relatively small research effort. The ESAS effectively postpones indefinitely the development of any major new nuclear capabilities while maintaining high-priority nuclear research efforts. The program will decline from roughly $430 million in fiscal year 2005 to $100 million in fiscal year 2006, of which $90 million is required for termination costs. NASA has said it needs to cut back any program that is not needed in the near term to free up funds to accelerate CEV development.

NASA's estimate for the cost to implement the ESAS through 2011 is $31.3 billion with a 65 percent confidence level (meaning there is a 65 percent chance the cost will be no more than $31.3 billion). NASA is able to state the cost with that confidence level because most of its work in the next five years is dedicated to developing elements of the ESAS, such as the CLV and heavy-lift launch vehicle, based on existing technology. Costs for the remainder of the program are not as precise. NASA estimates the cost of returning humans to the Moon by 2018 to be roughly $104 billion, but it has not developed an estimate of the confidence level of that estimate.

Status of Shuttle/Station Configuration Options Team (S/SCOT) Study

Griffin chartered a Shuttle/Station Configuration Options Team (S/SCOT) to determine what options the U.S. has for completing the ISS, given the plan to retire the Shuttle in 2010. Griffin has approved a plan for discussion with the U.S.'s international partners in the Station.

NASA has released a brief overview of some the study's main conclusions: NASA proposes to fly the Shuttle a total of 19 more times – 18 flights to the ISS beginning no earlier than May 2006, and a possible additional flight to service the Hubble Space Telescope, pending a decision that such a flight can be made safely, which NASA has said it would consider after the successful completion of the first Shuttle flight next year. (Last February, NASA testified that expected that 28 more Shuttle flights would be made to the ISS.)

The S/SCOT plan would allow the launch of key ISS elements, enabling a six-person crew to work on board. But under the plan, NASA will cancel plans to launch the Japanese-built Centrifuge Accommodation Module (CAM) that was designed to study the effects of low-gravity on small mammals. (The ISS itself allows NASA to monitor the effects of zero gravity, but not the effects of low gravity, such as the levels experienced on the Moon and Mars.) The National Academy of Sciences has said in the past that the absence of a centrifuge could hinder NASA's ability to gain the knowledge essential to maintain astronaut's health, safety, and well being on long-duration space expeditions.

The research program for ISS has undergone significant changes since the announcement of the President's Vision for Space Exploration. The budget for Human Systems Research and Technology (HSR&T), the bulk of which is ISS research, is proposed to decline by nearly half from slightly more than $1 billion in fiscal year 2005 to $533 million for fiscal year 2006. (NASA's proposed fiscal year 2006 budget was originally $806 million, but it has subsequently revised the request, reallocating the funding so as to accelerate the development of the CEV and CLV -- see below.) The cuts entail eliminating most research that does not relate to studying the impact of zero gravity on humans, for example research in the physical sciences. The proposed cuts will necessitate the termination of 322 grants.

Proposed Budget Amendments for Fiscal Year 2006

To implement the changes in the ESAS and S/SCOT, NASA has revised its fiscal year 2006 budget request twice since submitting the original request in February. In both cases the primary purpose was to provide additional funding to accelerate the CEV and CLV, and in both cases these funds were reallocated from within the Exploration Systems account.

The President submitted the first revision to NASA's budget as an official Budget Amendment that added $292 million to CEV and CLV development effort for fiscal year 2006. To pay for this increase, NASA proposed cutting $122 million from its Exploration Systems Research and Technology Accounts (advanced technologies for human and robotic missions to the Moon), $140 million from Prometheus (NASA's nuclear power and propulsion systems program), and $30 million from the Human Systems Research and Technology account (the bulk of which includes the funding for Space Station research).

The Budget Amendment also proposed to cut funding for future robotic missions to Mars to pay for near-term robotic Mars exploration programs, such as the Mars Science Laboratory and extension of the robotic rovers currently on Mars. The amendment would also provide $30 million to preserve the option of servicing the Hubble Space Telescope and would fully fund the Glory mission, an Earth Science mission that NASA has earlier tried to cut despite objections from several Members of Congress.

In late September, NASA submitted a second request effectively changing its fiscal year 2006 budget request as part of a fiscal year 2005 Operating Plan update, proposing to add an additional $493 million for CEV and CLV development efforts in fiscal year 2006. The plan would offset this increase by further cuts in the Exploration account. Specifically, it would cut Exploration

Systems Research and Technology by an additional $174 million, Prometheus by an additional $76 million, and Human Systems Research and Technology by an additional $243 million.

While the original request for CEV and CLV development efforts was $1.1 billion, the two revisions to the budget request raise that amount by a total of $785 million to $1.9 billion (a 70 percent increase).

Projected Space Shuttle Budget Shortfall

While NASA is increasingly committing funds within the its exploration program to high-priority efforts to develop a CEV and CLV two years ahead of its original plan, the agency is facing funding shortfalls in its Shuttle program. NASA's fiscal year 2006 – 2010 budget assumes that funding for the Space Shuttle program will decline by a total of approximately $4.8 billion over the next five years (see figure below) because of savings the agency had said two years ago that it expected to realize as the Shuttle approached its retirement date of 2010.

NASA's FY06 Shuttle Budget Projection ($ millions)

	FY06	FY07	FY08	FY09	FY10	
Space Shuttle Budget	4,530	4,172	3,865	2,815	2,419	
Projected Reduction from FY06 level	0	-358.2	-664.9	-1,715	-2,111	**Total -4,850**

However, given the high fixed costs associated with the Shuttle program, NASA acknowledges that it is highly unlikely that these cost savings will materialize. Indeed, Griffin has said that even canceling the Shuttle and ISS station programs today would save little because of termination costs, international obligations and the need to keep Shuttle staff together because of the Shuttle elements that are part of the CEV and CLV design.

NASA is studying options to reduce Shuttle costs, however. One option is to reduce the Shuttle workforce to a single shift that would process one Shuttle at a time. (Currently, NASA operates multiple shifts, sometimes around the clock, to prepare three Shuttle orbiters for flight.) While such a move might save some money, it could reduce the number of Shuttle flights that could be processed to possibly as few as two per year, requiring NASA to rethink its plans for completing the Space Station by 2010.

A second option under consideration is integrating the Shuttle program and the Exploration program to take greater advantages of overlapping needs for workforce skills and facilities. While this approach may achieve some savings, particularly since NASA is planning to use at least some of the current Shuttle workforce and infrastructure in the CEV program, NASA is not likely to fully realize such savings in time to address these near-term shortfalls in the Shuttle's budget.

Hurricane Katrina Response and Recovery

Hurricane Katrina inflicted significant damage on Stennis Space Center in Mississippi and Michoud Assembly Facility in Louisiana. The Michoud facility is located just outside New Orleans and is the manufacturing facility for the Space Shuttle's External Tanks. NASA's cost

estimate for the damage, including emergency response and programmatic costs is $760 million. To address immediate needs, NASA has identified $100 million in available funds – $15 from the Shuttle program and $85 million from International Space Station Crew/Cargo Services funding – that it has redirected toward NASA's immediate Katrina-related costs. NASA intends to repay the Shuttle and Space Station programs from any funds that Congress provides in an emergency supplemental appropriation.

Last week, the White House released a hurricane relief package to reallocate existing funds to address critical needs in the Gulf region. In this package, the Administration proposed to provide NASA with $325 million for the Michoud and Stennis centers – enough to cover expenses that would be incurred between now and May. It is not clear if a further supplemental request will cover the other half of NASA's hurricane expenses or if it will have to find that money by reprogramming other fiscal year 2006 funds.

Plans for Aeronautics Research

NASA's new plan for aeronautics will eliminate the four technology demonstration projects that were proposed in the fiscal year 2006 Budget Request: a project in subsonic noise reduction; a fuel cell powered aircraft; a project in sonic boom reduction; and a high-altitude, long-endurance, remotely-operated aircraft. Two other programs that were to be eliminated – hypersonics and rotorcraft – have been restored. A new "Foundational Technology" program is being created to focus on basic aeronautics research and to reinvigorate the agency's core competencies; and NASA is realigning several of its research programs to more directly address the needs of the Next General Air Transportation System, which NASA is pursuing in partnership with the Federal Aviation Administration and other agencies. NASA is also establishing a new office to manage its inventory of wind tunnels.

In addition to these agency efforts, NASA has contracted with the National Academy of Sciences for delivery of an industry/academia consensus plan that prioritizes aeronautics research projects it believes NASA ought to pursue. Its report is due to be delivered to NASA early next summer.

Both the House and Senate versions of the authorization bill and the House version of the appropriations bill direct the Administration to develop a National Aeronautics Policy to guide NASA's aeronautics research program.

Webb Telescope Cost Increase

Earlier this year, NASA announced that the cost of the James Webb Space Telescope, the planned successor to the Hubble Space Telescope and one of NASA's highest priority space science programs, would increase by approximately $1 billion to a total of $4.5 billion. NASA attributed the cost growth to higher-than-expected costs for integration and testing, cost increases for the instruments, and program delays because of uncertainty in the selection of a launch vehicle. The cost overruns were especially surprising because they occurred at an early stage of the program.

NASA has completed a review of the various options to scale-back the telescope and reduce costs, but NASA concluded that a less capable telescope was less desirable than slipping the schedule to complete the telescope originally envisioned. The mission was scheduled to be launched in 2011, but has now slipped to 2013. NASA managers assert that they have the technical content, cost, and schedule of the program under control and do not expect that additional funding above the President's request will be needed in fiscal years 2006 or 2007. The detailed re-planning for the program is scheduled to be complete in April 2006.

Workforce and Institutional Issues.

The reduction in aeronautics funding proposed in the fiscal year 2006 budget request could require the elimination of 1,100 civil service jobs at NASA centers, although NASA has said that there will not be any layoffs in fiscal year 2006. Also, the retirement of the Space Shuttle in 2010 and shift to the CEV will require NASA to make changes in the size and skill mix of a significant segment of the workforce at some centers. Work on the CEV and other elements of the mission to the Moon will significantly help offset the loss of Shuttle work, but some jobs and skills may still need to be eliminated. NASA may be able to help affected employees take advantage of training, retraining, and job placement programs to help the transition.

Questions Asked of the Witness:

Administrator Griffin was asked to describe NASA's proposed plans and the rationale for the changes in its programs since he last testified before the Committee this past June. He was asked to focus on the following:

(1) proposed plans for Exploration, including the likelihood that NASA will be able to accelerate the development of the Crew Exploration Vehicle;
(2) proposed plans to revamp the aeronautics research program, including the how they might affect NASA's facilities and workforce;
(3) proposed plans to reduce funding in Project Prometheus, Human Systems Research and Technology, and Exploration Systems Research and Technology;
(4) the status of plans for returning the Space Shuttle to flight, including efforts to reduce foam shedding and the impacts of the hurricanes to return to flight; and
(5) the range of options under consideration for flying the Space Shuttle and assembling the International Space Station.